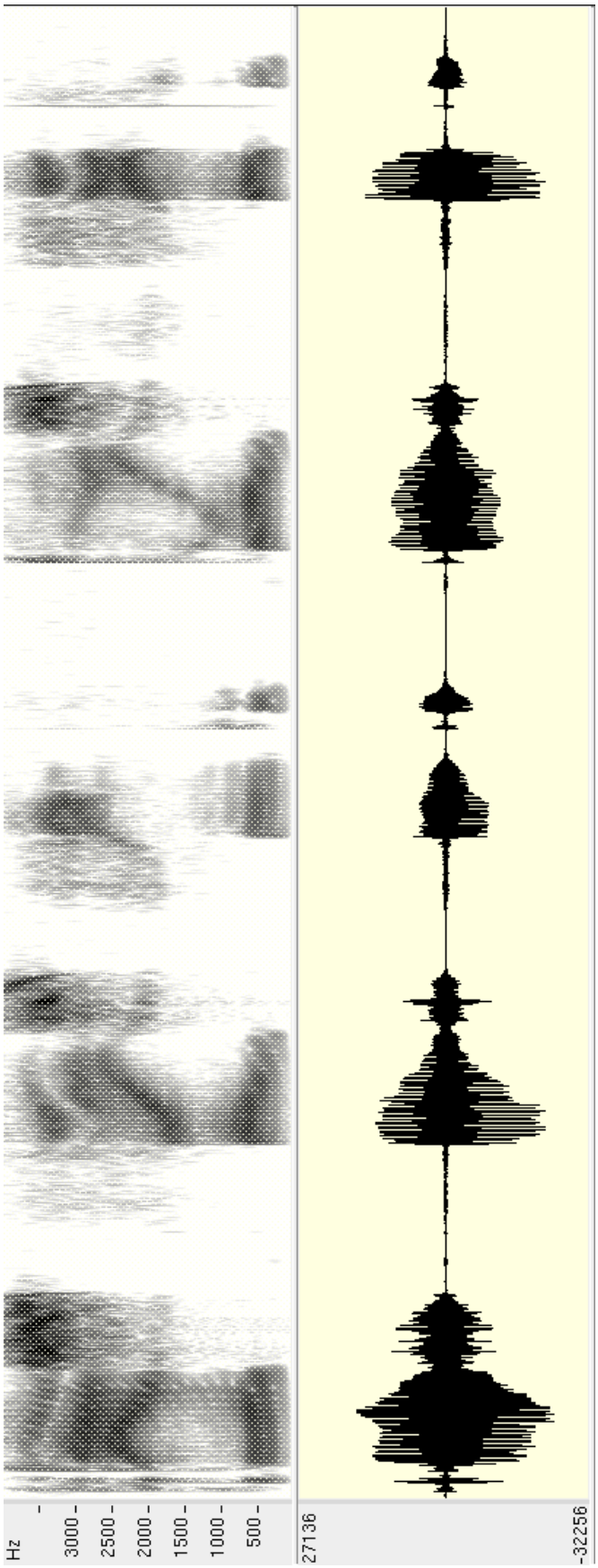
Speech Processing 2008/09

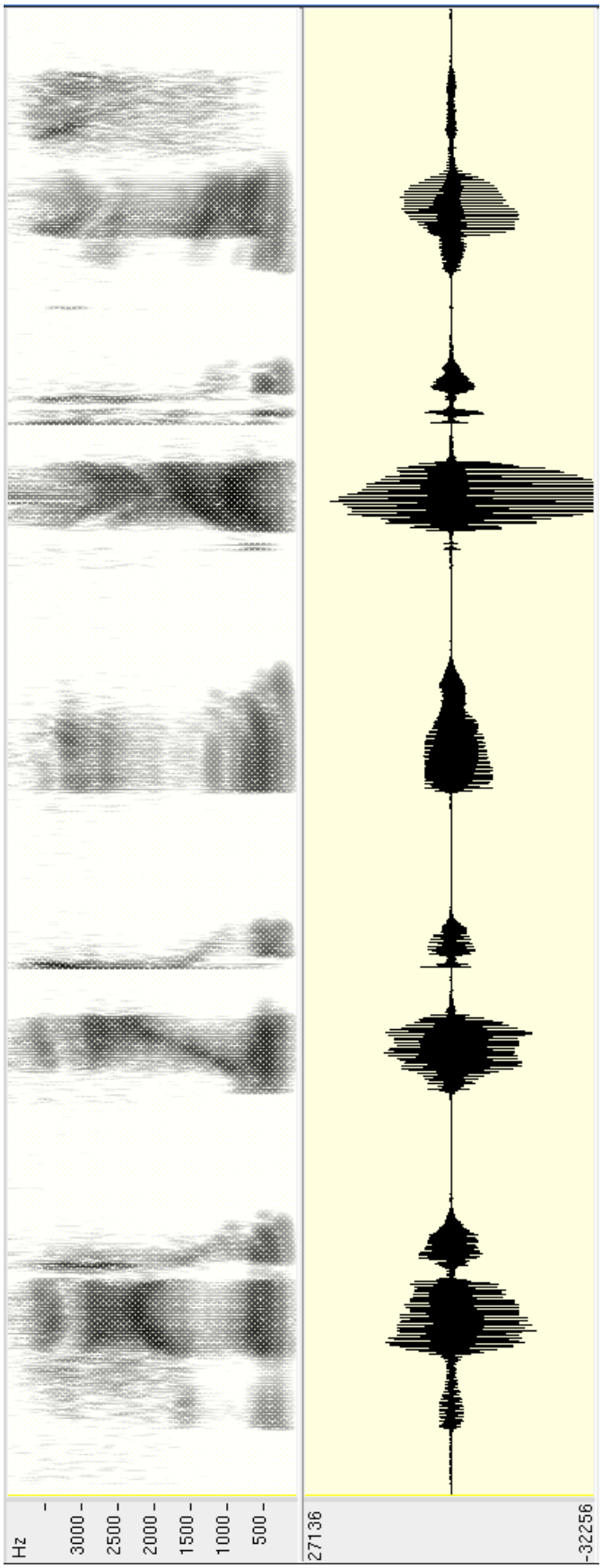
1st Test

April 6th 2009

Please identify this form with your name and student number in the reserved space at the bottom. The answers to multiple-choice questions will only be accepted if inserted in the appropriate place. Wrong answers will be penalized. The phonetic symbols should use the SAMPA alphabet (Lisbon accent).

1. Classify as True (T) or False (F)
   (a) In pitch detection algorithms, smoothing prevents jumps to double pitch frequencies.
   (b) In the Bark scale, the spacing between the central frequencies of the filter bank is logarithmic.
   (c) The two spectrograms in this test have been obtained with a narrow-band analysis.
   (d) Forward temporal masking is larger than backward.
   (e) The best part of the glottal cycle for computing a filter model is the closed phase.
   (f) Low order cepstral coefficients are a good model of the vocal tract.
2. Classify as True (T) or False (F)
   (a) The LPC covariance analysis method applies a window to the error signal.
   (b) The reflection coefficients have a broader dynamic range than the LPC coefficients.
   (c) Very high values of the linear prediction order cause modeling of individual harmonics.
   (d) Error minimization in linear prediction corresponds to a better modeling of the formants than the valleys between formants.
   (e) An all-pole filter is a good model for nasal vowels.
   (f) LSP coefficients are better for quantization than LPC coefficients.
3. Give examples of sounds for European Portuguese with the following properties (insert "-" in case they do not exist). Only one example is required for each category.
   (a) vowel low nasal
   (b) fricative dental unvoiced
   (c) plosive velar voiced
   (d) lateral palatal
4. What do we call the phonation type where the posterior part of the glottis remains open, without vibration?
5. What is the part of the human ear that (give answers as precise as you can)
   (a) maps the frequency of sound stimuli to localization?
   (b) helps in sound localization?
   (c) has the role of impedance transformation?
6. Compute the vocal tract length (cm) corresponding to a value of 750 Hz for the third formant of the neutral vowel, indicating intermediate steps. Can this correspond to a human being?
7. Write the expression for the cepstrum of a voiced signal, including as many cepstral components as possible. Indicate the names of the different components.


Hz
3000
2500
2000
1500
1000
500
27136
-32256


Hz
3000
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27136
-32256

8. Identify the 10-digit sequence by inspecting the spectrograms and waveforms in pages 2 and 3. There are no repeated digits. The recordings correspond to telephone speech.

9. Figures A and B present the short-time Fourier transform (magnitude) of a vowel segment, obtained with different window types, Hamming or rectangular (equal length). The LPC spectral envelope is also shown in one of them.

   (a) Indicate approximate values for F0, F1 and F2 (Hz).

   (b) May it correspond to a window of 5 ms?

   (c) May it correspond to a child voice?

   (d) May it correspond to vowel /a/?

   (e) May the spectral envelope be obtained with an LPC analysis of order 16?

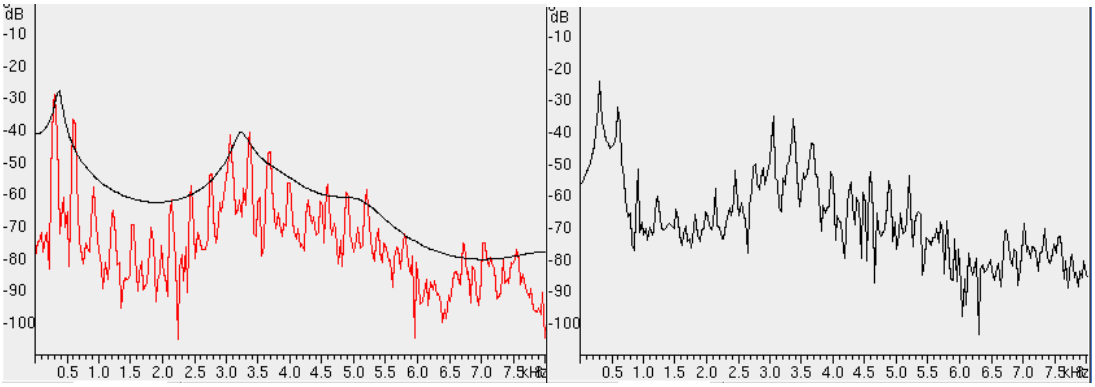
   (f) Does it correspond to telephone speech?

   (g) Which is the rectangular one (A or B)?

10. Consider the following sentences:
    Os Hospitais de Coimbra realizaram uma cirurgia
    que permite colocar um implante auditivo em pessoas
    com surdez neurosensorial, melhorando a sua qualidade de vida.

    (a) Write the broad phonetic transcription.

    (b) What are the missing nasal diphthongs in this transcription?



A B

Test 1 - Answers

Name:	
Number:	

1. (1.2 val.) Indicate T or F:

a	b	c	d	e	f

2. (1.2 val.) Indicate T or F:

a	b	c	d	e	f

3. (2.0 val.)

a	
b	
c	
d	

4 to 7. (0.8/0.9/2.5/1.5 val.)

4	
5 (a) 5 (b) 5 (c)	
6	
7	

8. (3 val.)

9. (4.5 val.) Complete:

F0	F1	F2	T/F	T/F	T/F	T/F	T/F	A/B

10. (2.0/0.4 val.)

(a)	
(b)	